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None

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G2F

(54) Liquid crystal cell arrangement for antiglare glasses

(57) An arrangement for driving liquid crystal cells in antiglare glasses, in which an adjustment to the varying light conditions is achieved on the basis of a self-acting transparency control.

A plurality of first liquid crystal cells (7.1, 7.2, 7.3), form an eye shield and are electrically connected to light sensors (4.1, 4.2, 4.3) via driving units (5.1, 5.2, 5.3). A further liquid crystal cell (3) is disposed in front of the light sensors (4.1, 4.2, 4.3) and is arranged to act as a variable light filter. The cell (3) is connected via a driving unit (2) to an additional light sensor (1) which is arranged to control the cell (3) in response to the ambient luminance.

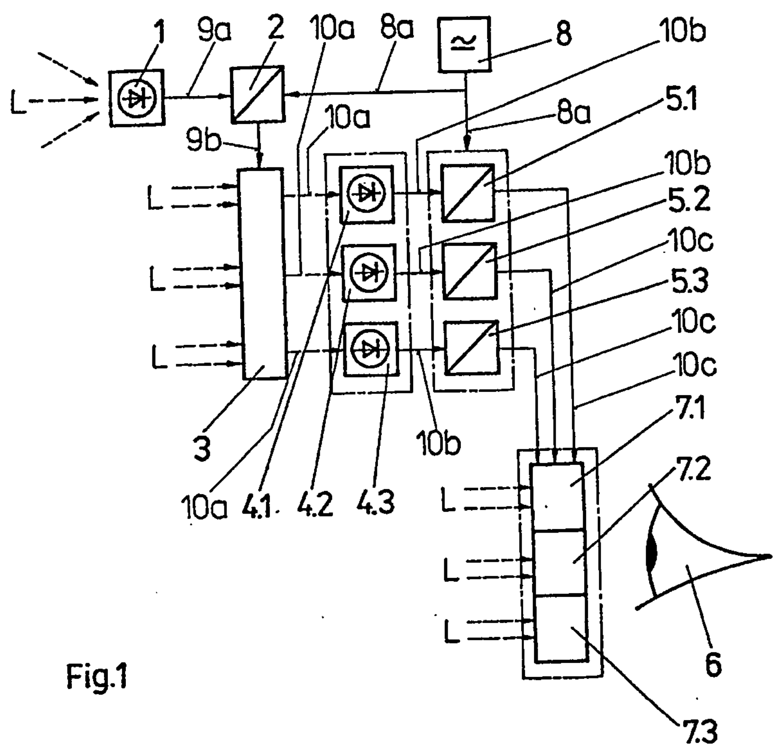

Fig.1

GB 2 137 373 A

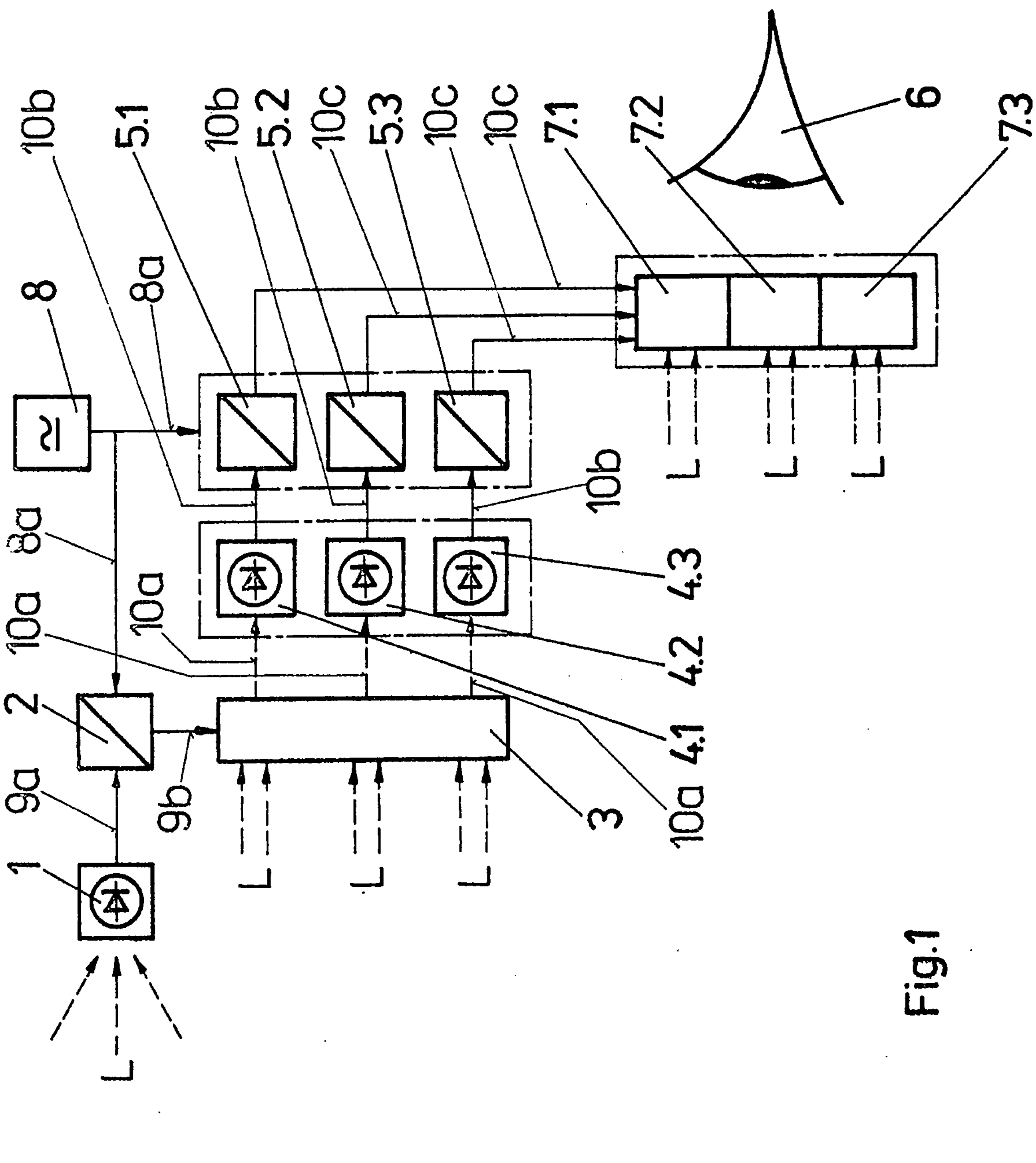

Fig.1

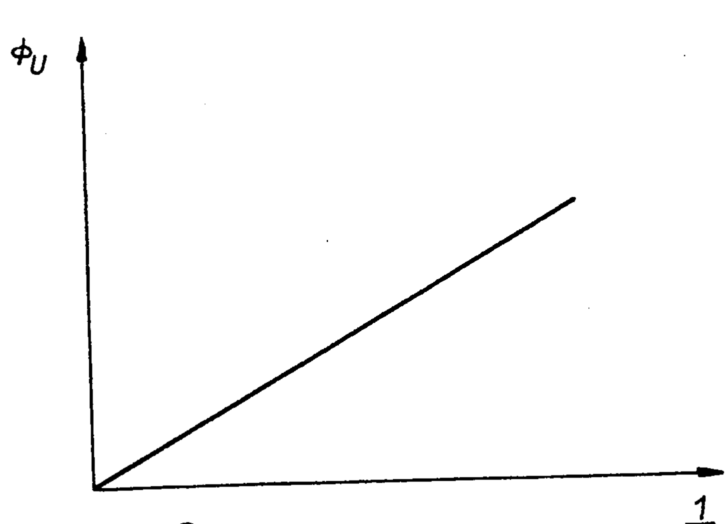

Fig.2

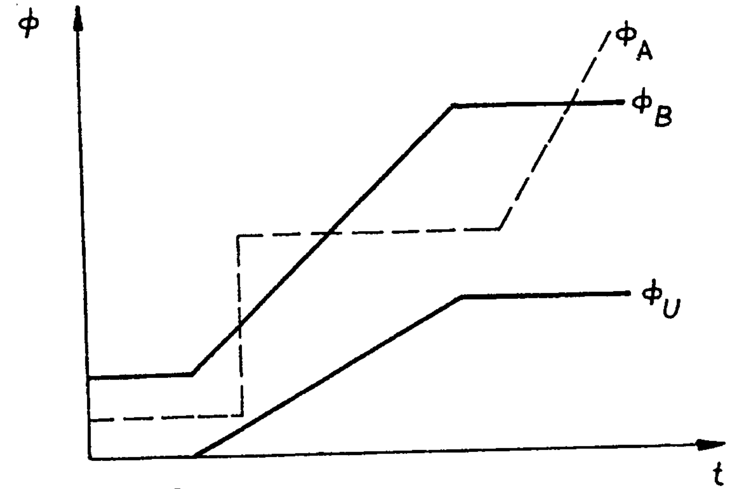

Fig.3

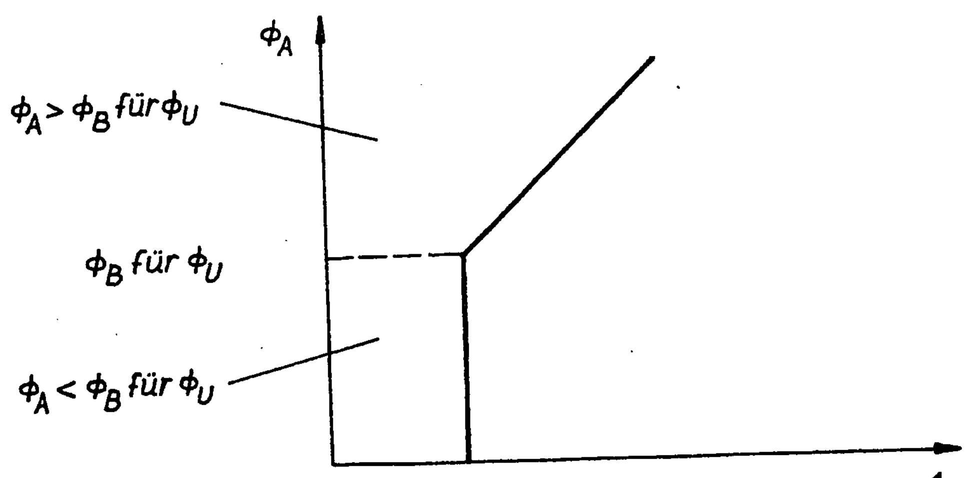

Fig.4

SPECIFICATION

Liquid crystal cell arrangement for antiglare glasses

The invention relates to a liquid crystal cell arrangement for antiglare glasses.

It is known in the art to achieve a transparency control of a plurality of liquid crystal cells dependant on the ambient light conditions using a reference signal detected by means of a light sensor. This reference signal represents a measure for the transparency control or, in fact, the controlling quantity for the latter. Consequently, this would mean that, for example in accordance with G.D.R. Patent application No. A 61F 243 77 1/1, for the embodiment of a transparency control for separately drivable liquid crystal cells being treated as a whole functional unit, it is essential to compare the value of the incident luminous intensity to a predetermined value of the luminous intensity considered to be the glaring value, for every liquid crystal cell or each group of such cells being compared with the light sensor. This comparison results in a signal representing the difference between the value of the incident intensity and the glaring value. Because this signal is not in itself sufficient for driving the liquid crystal cells it must be amplified afterwards. Furthermore, it is known that the level of luminous intensity causing glare depends on the ambient light conditions. For example. a light source can be perceived as a glare during night-time, when the human eye can only cope with small brightness differences, whereas the same light source does not appear as a glare in the day-time when the human eye can cope with larger brightness differences. The glaring value is, hence, not a constant but a variable quantity, which is dependant on the ambient brightness conditions.

It is an object of the invention to provide an arrangement for driving liquid crystal cells in antiglare glasses, wherein the transparency control of the liquid crystal cells adjusts to the varying ambient light conditions automatically.

It is a further object of the invention to provide an arrangement for driving liquid crystal cells in antiglare glasses, which relates the luminances possibly causing a glare, automaticallty to the ambient light conditions.

According to the present invention, there is provided a liquid crystal arrangement for antiglare glasses, comprising a plurality of first liquid crystal cells, which form an eye shield and which are electrically connected to first light sensors via first driving units, and an additional liquid crystal cell which is disposed in front of said first light sensor and which is arranged to act as a variable filter, said additional liquid crystal cell being connected, via a second driving unit, to an additional light sensor which is adapted to respond to the ambient luminance. Advantageously, each driving unit includes a control member for setting the response threshold of the arrangement and for aligning the transmission coefficient of the driving units.

Advantageously, the sensitivities of the first and additional light sensors are equal and the transmission coefficients of the first and second driving units are equal, and the material of the liquid crystal cells forming the eye shield has a flatter electro-optical characteristic than that of the material of the liquid crystal cell acting as a variable filter.

Preferably, the sensitivities of the first light sensors which are electrically connected to the liquid crystal cells forming the eye shield are lower than that of the said additional light sensor for measuring the ambient luminance, the electro-optical characteristics of the liquid crystal cells being congruent and the transmission coefficients of the driving units being equal.

Advantageously, if the electro-optical characteristics of the liquid cells are congruent and the sensitivities of the light sensors are equal, the transmission coefficients of the driving units electrically connected to the liquid crystal cells forming the eye shield, are lower than the transmission coefficient of that driving unit, which is electrically connected to the liquid crystal cell acting as a variable filter.

To relate a luminance which might cause a glare to the ambient average luminance, it is necessary for the transmittance of the liquid crystal cell which is disposed in front of the light sensors to vary as a function of the ambient brightness in the same mode as the luminance, which might cause a glare, varies as a function of the ambient luminance. Hence, it is an advantage to set a response threshold for the liquid crystal cells of the eye shield, with the exceeding of the threshold being equivalent to a glare effect and causing the liquid crystal cells to be obscured in dependence on the luminance.

It can occur that one and the same signal value, which causes the liquid crystal cells of the eye shield to be obscured, corresponds to different luminances, each causing a glare, in dependence on the ambient luminance.

Advantageously, the entire driving process is reduced to a comparison to a fixed value, which is the response threshold.

It is an advantage of the present arrangement that it can be achieved using simple electronics. There is no comparing of the measured parameters to state differences between them and, hence, no differential amplifier is necessary. These features permit, advantageously, the use of the portable arrangement under constantly varying light conditions. Adaption to the relevant light conditions is carried out automatically. Additionally, it is an advantage of the present arrangement that it permits the embodiments wherein the compensation of manufacturing tolerances can be achieved by the use of control members provided in the driving units.

Furthermore, the arrangement is particularly appropiate for both day and night usage of the antiglare glasses since the varying ambient light conditions are automatically taken into account.

The present invention will now be described further hereinafter, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 shows an arrangement in accordance with the present invention for driving a plurality of liquid crystal cells in antiglare glasses;

Figure 2 shows a diagrammatic representation of

the transmittance τ_3 as a function of the ambient luminance Φ_u,

Figure 3 shows the relation between the ambient luminance Φ_u and the luminance Φ_B being perceived as a glare dependant on the time t; and

Figure 4 shows the transmittance τ_7 as a function of the luminance Φ_A in a restricted angle of vision range.

In Figure 1 the schematic representation of an arrangement for driving a plurality of liquid crystal cells in antiglare glasses is shown. The antiglare glasses consist of eye shields mounted in a frame (not visible) with arms (not visible). The eye shields are formed from liquid crystal cells 7.1, 7.2, 7.3. Light sensors 1, 4.1, 4.2, 4.3, oriented towards the optical viewing direction, as well as associated driving units 5.1, 5.2, 5.3, are mounted in the frame of the eye shields. A liquid crystal cell 3, acting as a variable filter, is disposed in front of the light sensors 4.1, 4.2, 4.3, and, as a result, the incident light L impinges as a filtered attenuated light 10a on the light sensors 4.1, 4.2, 4.3. The light sensor 1 for measuring the ambient luminance is not covered by the liquid crystal cell 3, but, via signal lines 9a (input), 9b (output) and a driving unit 2, is directly electrically connected to it. The light sensors 4.1, 4.2, 4.3, in turn, are connected to the relevant sections of the liquid crystal cells 7.1, 7.2, 7.3 forming the eye shield for the human eye 6. In detail, this electrical connection is embodied as follows: the light sensors 4.1, 4.2, 4.3 are connected to the driving units 5.1, 5.2, 5.3 via the respective signal lines 10b, and the driving units 5.1, 5.2, 5.3, in turn, are connected to the liquid crystal cells 7.1, 7.2, 7.3 via the signal lines 10c. A power supply unit 8 is connected to the driving units 2 and 5.1, 5.2, 5.3 via signal lines 8a. The driving units 2, 5.1, 5.2, 5.3 each include a control member (not visible) for aligning the transmission coefficient of said driving units.

The representations in Figures 2 to 4 are used to illustrate the mode of operation of the abovedescribed arrangement.

The light sensors 4.1, 4.2, 4.3 and the appertaining driving units 5.1, 5.2, 5.3 are matched to the liquid crystal cells 7.1, 7.2, 7.3 such that, when a preset threshold value of light intensity is exceeded, a signal is delivered by the relevant driving units 5.1, 5.2, 5.3, which effects a variation of the transmittance τ_7 of the affected sections of the liquid crystal cells 7.1, 7.2, 7.3. Above the threshold value of light intensity, the transmittance τ_7 is varied in dependence on the luminance Φ_B of the glaring radiation.

The filtered light impinging onto the light sensors 4.1, 4.2, 4.3 is controlled in dependence on the ambient luminance Φ_u by the light sensor 1, the driving unit 2 and the liquid crystal cell 3. Figure 2 shows a diagrammatic representation of the transmittance τ_3 as a function of the ambient luminance Φ_u.

As is known, the luminance Φ_B being perceived as a glare depends on the ambient luminance Φ_u, as it is represented in Figure 3 in dependence on the time t. This means that in a restricted angle of vision range and at a certain value of the ambient luminance Φ_u, the luminance Φ_A is only then perceived as glaring if it exceeds the value Φ_B. In the graph of Figure 4, the luminances Φ_A is subdivided into sections $\Phi_A < \Phi_B$ at a certain ambient luminance Φ_u and $\Phi_A > \Phi_B$ at a certain ambient luminance Φ_u, the graph indicating the relation between Φ_A and τ_7.

Since the light sensors 4.1, 4.2, 4.3, changing the transmittance $_7$ of the liquid crystal cells 7.1, 7.2, 7.3, are optically coupled with the liquid crystal cell 3 acting as a filter, and the transmittance τ_3 of the liquid crystal cell 3 changes as a function of the ambient luminance Φ_u, it is achieved that the transmittance τ_7 changes in dependence on the luminance Φ_A, occuring in a restricted angle of vision range, and on the ambient luminance Φ_u provided that $\Phi_A > \Phi_B$ for a certain Φ_u. Hence, the arrangement is automatically adjusted to the specific light conditions L, and, for that purpose, the required dependent between the ambient luminance Φ_u and the luminance Φ_B being perceived as a glare, is obtained by a simple optical coupling system.

Possibilities for obtaining the required dependence between Φ_A and Φ_B, which are predetermined by the transmittance of liquid crystal cell 3: τ_3, and the transmittance τ_7 of the liquid crystal cells 7.1, 7.2, 7.3, dependent on Φ_u or Φ_A, respectively, are given in the form of the sensitivities of the light sensors 1, 4.1, 4.2, 4.3, the transmission coefficients of the driving units 2, 5.1, 5.2, 5.3, and the behaviour of the electro-optical characteristic of the liquid crystal cells 7.1, 7.2, 7.3. The said required dependencies are obtained by adjusting the transmission coefficients. This is carried out, first of all, by means of the control members (not visible) of the driving units 2, 5.1, 5.2, 5.3. At the same time, the response threshold of the liquid crystal cells 7.1, 7.2, 7.3 is set, with the exceeding of the response threshold effecting a variation of the transmittance τ_7. The transmittance τ_3 of the liquid crystal cell 3 has no response threshold, as is indicated in Figure 2.

CLAIMS

1. A liquid crystal cell arrangement for antiglare glasses, comprising a plurality of first liquid crystal cells, which form an eye shield and which are electrically connected to first light sensors via first driving units and an additional liquid crystal cell which is disposed in front of said first light sensors and which is arranged to act as a variable filter, said additional liquid crystal cell being connected, via a second driving unit, to an additional light sensor which is adapted to respond to the ambient luminance.

2. An arrangement as claimed in claim 1, wherein the first and second driving units each include a control member for setting the response threshold of the arrangement and for adjusting the transmission coefficient of the driving units.

3. An arrangement as claimed in claim 1, wherein the sensitivities of the first and additional light sensors are equal and the transmission coefficients of the first and second driving units are equal and the material of the liquid crystal cells forming the eye shield has a flatter electro-optical characteristic than that of the material of the liquid crystal cell acting as

a variable filter.

4. An arrangement as claimed claim 1, wherein the sensitivities of the first light sensors which are electrically connected to the liquid crystal cells forming the eye shield are lower than that of the said additional light sensor for measuring the ambient luminance, the electro-optical characteristics of the liquid crystal cells being congruent and the transmission coefficients of the driving units being equal.

5. An arrangement as claimed in claim 1, wherein the transmission coefficients of the first driving units electrically connected to the liquid crystal cells forming the eye shield are lower than the transmission coefficient of said second driving unit, which is electrically connected to the liquid crystal cell acting as a variable filter, the electro-optical characteristics of the first and additional liquid crystal cells being congruent and the sensitivities of the first and second light sensors being equal.

6. A liquid crystal cell arrangement for antiglare glasses, constructed and adapted to operate substantially as herein described with reference to and as illustrated by the accompanying drawings.

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